Attorney Docket No.: 042390.P6942                                            *Patent*

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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|---|---|
| In re Application of: ) | |
| ) | |
| Nardin et al. ) | Examiner: Craig, Dwin M. |
| ) | |
| Application No.: 09/475,717 ) | Art Unit: 2123 |
| ) | |
| Filed: December 30, 1999 ) | |
| ) | |
| For: METHOD AND APPARATUS FOR FULLY ) | |
| AUTOMATED SIGNAL INTEGRITY ) | |
| ANALYSIS FOR DOMINO CIRCUITRY ) | |

Commissioner for Patents
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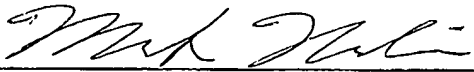### DECLARATION PURSUANT TO 37 C.F.R. §1.131

Sir:

I, Mark D. Nardin of Portland, Oregon, do hereby declare that:

1. I am a co-inventor of the above-captioned patent application and a co-inventor of the subject matter described and claimed therein.

2. Intel Corporation of Santa Clara, California, is the assignee of the patent application described above.

3. I am currently employed by Intel Corporation.

4. Prior to November 1, 1999, I in cooperation with my fellow co-inventors reduced to practice the invention as claimed in the above-captioned patent application (hereinafter "the present invention") in this country, as evidenced by Exhibits A and B. Both of these documents, in their redacted form, where generated prior to November 1, 1999.

5. Exhibit A is a redacted Modification Log of software code, which practiced the present invention. The Modification Log shows that the present invention was reduced to practice prior to November 1, 1999. The last entry in the Modification Log was entered prior to November 1, 1999.

6. Exhibit B is a portion of an Output Log of software code that practiced the present invention. The Output Log was generated by the software code prior to November 1, 1999.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issued thereon.

Respectfully submitted,

Date _Nov. 21_____, 2003 _____

Mark D. Nardin

# EXHIBIT A

```
#*********************************************************************
#* Filename: domino_manager     Project: Cop
#*********************************************************************
#*
#* (C) Copyright Intel Corporation, ████.
#* Licensed material -- Program property of Intel Corporation
#* All Rights Reserved
#*
#* This program is the property of Intel Corporation and is furnished
#* pursuant to a written license agreement. It may not be used, reproduced,
#* or disclosed to others except in accordance with the terms and conditions
#* of that agreement.
#*
#*********************************************************************
#*
#* Original Author: Hans J. Greub   Email: ███████████
#*
#* Functional description:
#*
#* This script extracts domino circuits and simulates the dominos and
#* inverting gates igates in stages using dominosim for simulating the
#* the dominos for chargesharing, residual (propagated noise from the
#* input to the output), and the injected crosstalk voltage at the output,
#* and using go_nm to characterize UGNMH vs Vout for custom or zgcells
#* connected to dominos and and then propagates the worst case
#* voltage drop on the domino output through the inverting gates to get
#* the input residual for the next domino stage.
#* All propagated residuals are captured in the file:
#* xcap/domino/data/<fub>.residual
#* A margin report for all domino outputs is written to the file:
#* xcap/report/<fub>.domino_finalreport
#*
#*********************************************************************
#*
#*
#*********************************************************************
# Implementation Notes:
#*********************************************************************
#
# Data Structures
#
# The Domino Output Noise Info is stored in the hash:
# $DomOutput{$pathmill_node_name}=\@domino_output_record;
# each entry contains pointer to a domino_output_record with the following format:
#
@domino_output_record=($Reff,$Rline,$Ctot,$Cx,$Residual,$Peak,$Fub_Pin,$Supply_Noise,$ChargeSh
aring,$Average_Attacker_Slope,$assumed_fixed_value); '
# The Domino Input Noise Info is stored in the hash:
# $DomInput{$pathmill_node_name}=\@domino_input_record;
# Each entry points to a record which contains:
#
@domino_input_record=($Reff,$Rline,$Ctot,$Cx,$Residual,$Source_of_Residual,$Peak,$Fub_Pin,$Suppl
y_Noise,$Average_Attacker_Slope);
# changed keys from ipath to pathmill notation
```

```perl
# - added the mapping hashes for simulation
#   %map_out2igate{$node} ="igate${id}$fub"
#   %map_out2domino{$node}="dom${id}$fub"
#   these hashes map an output node to a domino or igate cell name
# added the following hashes
#
@receiver_record=($domino_driven_input_pin,$source_config,$invelm_output,$invelm_name,$invelm_ty
pe);
# The hash %map_igate_out2igate_record maps igate outputs to igate records
# @igate_record=($invelm_type,$source_config,\@domino_driven_input_list,
#           \@domino_driven_input_pin_list,$invelm_name);

# obsolete $map_igate_receiver{$domino_driven_input}=\@receiver_records;
# $map_igate_out2cell_type{$igate_output}=$cell_type;
# The residual on igate outputs must be propagated thru
# passgates. The hash %short_igate2dynin with key $igate_output_node
# points to an array (list) of dynin nodes to which the residual
# needs to be propagated.
# $short_igate2dynin{$igate_node}=\@dynin_node_list;
# push(@{$short_igate2dynin{$igate_node}},$dynin_node);
#
# Modification Log
#██████- added fub_boundary condition check for fub outputs
#       - added fub_boundary statements for fub input
#       - changed no receivers found on domino outputs to
#         warning messages to handle nocons better
#██████- moving databases instead of deleting them!
#██████- fixed bug in domino_stageN.pN cell list generation
#█████  - changed noise propagation from DYNOUT based to igate cell
#         based to conform to order in sim_sequence
#█████  - added -use_previous_results feature
#█████  - added archiving and output of $fub.residuals
#██████- added database migration for -start_fresh option
#█████ - added $ENV{CSEJOBNOMAIL}="TRUE";
#██████- removed path to /usr/home1/hgreub version of
#         igate_identify
#██████ - removed path checking for domino_extract because
#         it hangs in CTM
#       - changed tcsh path since /bin/tcsh does not work in
#         CTM
#██████- fixed bug in migrate_dp which cause domino_manager
#         to quit if -start_fresh option is used and no db
#         datafiles exist
#██████- fixed 'nbq -Pcs' instead $command_prefix bug in
#         domino simulate section
#█████ - added -f flag to tcsh to fix some problems with
#         setup in CTM
#██████ - added support for custom cells that the user wants
#         to treat like standard cells
#         if a cell custom_cell that is listed in the inv_element_fub.dat
#         file and thus was declared to be treated like a standard cell
#         in the xcap/domino/igate_no_extract_fub.dat file, domino_manager
#         looks for a command file "custom_cell.cmd" and if it exists
#         will simulate this cell once and read in the results
```

2

```
#████- removed -x from tcsh -f -x
#████- changed pathmill2plus to not add fubname prefix for fub pins
#████- changed read_transgate_domino_sim, looks like header in the
#      file changed
#████ - fixed bug in UGNMH computation, lowest UGNMH instead of highest
#      UGNMH with lowest NT was kept
#████ - fixed bug in residual propagation through passgates, the new
#      residual value was copied in without checking whether the existing
#      value is (worst case)
#      - fixed argument processing so that domino_manager -<anything> gives
#      usage message
#████- added handling of case if 2*($vout-2*$vout2) is zero
#      in compute_propagated_residual()
#████- added check for TIM version 2.8.b1
#████- added message to re-run xcap_mutex and xcap_change_psn
#████- added handling of domino/igate not reported condition in
#      sim seq file
#████ - fixed migrate_db() for igate
#████- fixed worst noise level reported in domino_finalreport
#████- added an enhancement to deal with multiple tri-state drivers
#      connected to an igate output node (works for stdcells only)
#████- fixed domino residual propagation bug, fub.residuals was correct
#      but %DomInput data was still bad
#████- increased min chunk from 12 to 24 because of netbatch overflow.
#████ - changed initial values in DomOutput to make sure dominos that
#      have not been simulated will fail
#████ - added sanity checks to read_sim_seq files
#████- fixed residual propagation through passgates
#████ - added archiving of siminofo file used for domino simulation


$VERSION="2.0";
$last_modified=████████
```

This gives a time date of the LAST modification of some other "underlying" scripts that domino_manager calls to do needed functions.

```
████>ls -l
total 124
-rwxr-xr-x  1 ████ users  ████████ build_for_xcap
-rwxr-xr-x  1 ████ users  13009 ████ domino2ipath
-rwxr-xr-x  1 ████ users  10042 ████ domino_extract
-rwxr-xr-x  1 ████ users  7072 ████ ggate_extract
-rwxr-xr-x  1 ████ users  7710 ████ igate_extract
```

From the code "domino_extract":

```
#!/bin/csh

# Created ████ by Mark Nardin
# For use in extracting domino circuit netlists for simulation
```

```
set DOM_EXTRACT_EXE = $0

if ( ($#argv == 0) | ($1 == "-help") ) then
  echo " "
  echo "This MUST be run from a setup window where plus can be run. "
  echo " "
  echo " "
  awk '/^#BEGINhelp_message/ {\
    getline\
    while ( $1 != "#ENDhelp_message") {\
      print\
      getline\
    } }' $DOM_EXTRACT_EXE
  exit 0
endif

setenv WARD $WORK_AREA_ROOT_DIR
setenv FUB $1$2
setenv fub $1

if !(-e $WARD/plus/frz/xcap_$fub.frz) then
  echo " "
  echo " Can not find the required freeze file:"
  echo "   "$WARD/plus/frz/xcap_$fub.frz
  echo " "
  echo " Run the script: build_for_xcap "
  echo " "
  exit 0
endif


# Record the current directory
set CUR_DIR = `pwd`

# Make the master command file that needs to be executed in plus
#
rm -f $WARD/plus/cmd/domcall_tmp_$FUB.cmd
#
# Making the start-up sequence for PLUS to run
#
echo " Running plus and restarting the freeze file from xcap_<fub>.frz"
echo "restart xcap_$fub" > $WARD/plus/cmd/domcall_tmp_$FUB.cmd
#
# Making the series of commands that need to be run for each of the
# individual domino nodes
#
awk ' /^/ { \
print "put n "$1" domoutput_erc := TRUE"; \
print "@'"$WARD"'/plus/cmd/domselect_plus_'"$FUB"'.cmd"; \
print "@'"$WARD"'/plus/cmd/select_temp_'"$FUB"'.cmd"; \
print "system date"; \
print "simulate -nojob -ignore -selected -sdp dom"$2"ext'"$fub"'"; \
print "system process_ext dom"$2"ext'"$fub"'.sdp -create_template"; \
print "system source '"$WARD"'/plus/cmd/make_delete_file_'"$FUB"'.tmp"; \
```

4

```
print "@'"$WARD"'/plus/cmd/delete_sources_'"$FUB"'.tmp" } ' \
 $WARD/plus/erc/domout_nodes_$FUB.dat >> $WARD/plus/cmd/domcall_tmp_$FUB.cmd

# Make the plus command file that actually extracts the iPath
# command file statements
#
```

**EXHIBIT B**

```
ptdl:        >ls -l
total 528
-rwxr-xr-x  1        cop   1139     ##          #.ptdis91.gz
-rwxr-xr-x  1        cop    473     ##          #.ptdis12.gz
-rw-r--r--  1        cop    265         faaddc.domino_extract_audit.gz
-rw-r--r--  1        cop   5749         faaddc.domino_finalreport.complete.gz
-rw-r--r--  1        cop   5759         faaddc.domino_finalreport.gz
-rw-r--r--  1        cop   5749         faaddc.domino_finalreport.previous.gz
-rw-r--r--  1        cop   3415         faaddc.domino_simulate.audit.gz
-rw-r--r--  1        cop  495820        faaddc.xcap_finalreport.gz

ptdl:        >gzless faaddc.domino_finalreport.gz
```

```
***************************
* DOMINO FLOW XCAP REPORT *
***************************
```

domino_manager version 2.0, last modified on ▇▇▇▇

Command Line    : domino_manager faaddc -simulate -parallel 8 -netbatch iss_short
TimeStamp       : ▇▇▇▇▇▇▇▇

USER            : ▇▇▇▇
WORK_AREA_ROOT_DIR: /prj/cop/work_root/feu/▇▇▇/faaddc
Note: The worst domino input residual reported is the worst residual
propagated to the inputs from a previous domino stage, the worst case
domino input noise is the worst total noise (power_supply_noise+residual+xtalk)
on any domino input (not necessarily the input that had the worst residual)

Report for all DYNOUT Nodes sorted based on margin

?.???V DYNOUT faaddd/i34/pp[71]      (dom194faaddc)
      -W- no receiver found, verify NOCON!
      Voltage Drop: 0.130V (ChgSh(0.010V)+Residual(0.040V)+XTalk(0.055V)+PSN(0.025V))
      worst domino input noise  : 0.111V on node: faaddd/i34/i13/i1/pp2nn[3]
      worst domino input residual: 0.029V from dom245faaddc

?.???V DYNOUT faaddd/i34/gg[71]      (dom144faaddc)
      -W- no receiver found, verify NOCON!
      Voltage Drop: 0.199V (ChgSh(0.001V)+Residual(0.032V)+XTalk(0.141V)+PSN(0.025V))
      worst domino input noise  : 0.120V on node: faaddd/i34/i13/i1/gg2nn[1]
      worst domino input residual: 0.029V from dom245faaddc

*** The Noise on the following Domino Output Nodes is below the Receiver UGNMH ***

+0.032V DYNOUT faaddd/i34/i31/gout[5]  (dom104faaddc)
      Voltage Drop: 0.186V (ChgSh(0.001V)+Residual(0.085V)+XTalk(0.075V)+PSN(0.025V))
      worst receiver UGNMH      : 1.582V (NT:0.218V) from
zgca2nox800040x4000040x1024040x4000040
      worst domino input noise  : 0.197V on node: faaddd/i34/i31/gg2nn[1]
      worst domino input residual: 0.073V from dom55faaddc

+0.037V DYNOUT faaddd/i34/gg[29]      (dom82faaddc)
      Voltage Drop: 0.208V (ChgSh(0.000V)+Residual(0.031V)+XTalk(0.152V)+PSN(0.025V))
      worst receiver UGNMH      : 1.555V (NT:0.245V) from
zgca2nox1000040x4000040x1024040x4000040
      worst domino input noise  : 0.120V on node: faaddd/i34/i6/i1/gg2nn[1]

1

worst domino input residual: 0.028V from dom137faaddc

+0.048V DYNOUT faaddd/i34/gg[17]     (dom211faaddc)
     Voltage Drop: 0.197V (ChgSh(0.000V)+Residual(0.031V)+XTalk(0.141V)+PSN(0.025V))
     worst receiver UGNMH     : 1.555V (NT:0.245V) from
zgca2nox1000040x4000040x1024040x4000040
     worst domino input noise   : 0.120V on node: faaddd/i34/i4/i1/gg2nn[1]
     worst domino input residual: 0.028V from dom72faaddc

+0.050V DYNOUT faaddd/i34/pp[11]     (dom55faaddc)
     Voltage Drop: 0.261V (ChgSh(0.010V)+Residual(0.031V)+XTalk(0.195V)+PSN(0.025V))
     worst receiver UGNMH     : 1.489V (NT:0.311V) from
zgca2nox1400040x3600040x1024040x3600040
     worst domino input noise   : 0.111V on node: faaddd/i34/i3/i1/pp2nn[3]
     worst domino input residual: 0.028V from dom168faaddc

+0.051V DYNOUT faaddd/i34/pp[23]     (dom189faaddc)
     Voltage Drop: 0.194V (ChgSh(0.010V)+Residual(0.031V)+XTalk(0.128V)+PSN(0.025V))
     worst receiver UGNMH     : 1.555V (NT:0.245V) from
zgca2nox1000040x4000040x1024040x4000040
     worst domino input noise   : 0.111V on node: faaddd/i34/i5/i1/pp2nn[3]
     worst domino input residual: 0.028V from dom233faaddc

+0.055V DYNOUT faaddd/i34/pp[53]     (dom126faaddc)
     Voltage Drop: 0.242V (ChgSh(0.010V)+Residual(0.033V)+XTalk(0.174V)+PSN(0.025V))
     worst receiver UGNMH     : 1.503V (NT:0.297V) from zi0bna02he
     worst domino input noise   : 0.111V on node: faaddd/i34/i10/i1/pp2nn[3]
     worst domino input residual: 0.029V from dom24faaddc


***************************
* SUMMARY of DOMINO REPORT *
***************************

249 dominos were found in FUB: faaddc

0 dominos were not mapped or extracted
2 dominos had no receivers (NOCONS?)
0 dominos were assumed to be fixed for noise propagation
0 domino circuits had negative noise margins